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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/666,325	09/21/2000	Douglas S. Armbrust	BU9-98-110 DIV	1958

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EXAMINER

KANG, DONGHEE

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 07/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/666,325

Applicant(s)

ARMBRUST ET AL.

Examiner

Donghee Kang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 21-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 21-24 and 27-32 is/are rejected.
- 7) ☒ Claim(s) 25-26 and 33-34 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. In view of the appeal brief filed on April 18, 2003, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

- (1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,
- (2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

Claim Objections

2. Claims 21 & 29 are objected to because of the following informalities: The phrase "said uppermost layer" is object because of antecedent basis. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims **21-22 & 27-30** are rejected under 35 U.S.C. 103(a) as being unpatentable over Filipiak et al. (US 5,447,887).

Regarding claim **21**, Filipiak et al. teach a semiconductor device comprising (Fig.5):

an exterior surface having a top level of metallurgy (30), wherein the top level of metallurgy comprises a silicide surface (32) which should not be greater than 10 % of the thickness of metallurgy (Col.5, lines 63-65).

Filipiak et al. does not teach the silicide thickness being in the ranges 10% to 20% of the total thickness of the copper interconnect layer. However, Filipiak et al. teach the silicide thickness having no greater than 10 % of the thickness of metallurgy which is in the claimed ranges.

See MPEP 2144.05. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed.Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm [i.e., 100Angstroms]." The court stated that "by stating that suitable protection' is

provided if the protective layer is about' 100 Angstroms thick, [the prior art reference] directly teaches the use of a thickness within [applicant's] claimed range.").

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the silicide thickness being in the ranges 10% to 20% of the total thickness of the copper interconnect layer, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding claim **22**, Filipiak et al. teach a bottom 80% to 90% of said bonding pad is free of silicide.

Regarding claim **27**, Filipiak et al. teach the semiconductor device further comprising at least one internal level of metallurgy (26) within an interior of said semiconductor device, wherein said top level of metallurgy is thicker than said internal level of metallurgy.

Regarding claim **28**, Filipiak et al. teach said top level of metallurgy comprising copper.

Regarding claim **29**, Filipiak et al. teach a semiconductor chip comprising (Fig.5): an exterior surface having a top level of metallurgy (30); and an interior having at least one internal level of metallurgy (26), wherein said top level of metallurgy is thicker than said internal level of metallurgy,

Wherein an exposed portion of said top level of metallurgy comprises a bonding pad,

Wherein an upper 10% of said bonding pad comprises a silicide surface, and
Wherein a thickness of said uppermost layer reduces sensitivity to resistivity shifts associated with said silicide surface.

Filipiak et al. does not teach the silicide thickness being in the ranges 10% to 20% of the total thickness of the copper interconnect layer. However, Filipiak et al. teach the silicide thickness having no greater than 10 % of the thickness of metallurgy which is in the claimed ranges.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the silicide thickness being in the ranges 10% to 20% of the total thickness of the copper interconnect layer, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding claim **30**, Filipiak et al. teach a bottom 80% to 90% of said bonding pad is free of silicide.

5. Claims **23-24 & 31-32** are rejected under 35 U.S.C. 103(a) as being unpatentable over Filipiak et al. (US 5,447,887) in view of Ngo et al. (US 6,303,505).

Filipiak et al. do not teach prior to formation of said silicide surface, said bonding pad is cleaned by applying one of an ammonia plasma and a hydrogen plasma to make said bonding pad free of said oxides and silicide islands.

Ngo et al. teaches the method of cleaning of top level of metallurgy by applying a hydrogen-containing plasma prior to formation of silicide surface (Col.5, line 60 - Col.6, line8) to make top level of metallurgy is free of oxides and silicide islands.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of Ngo with Filipiak's device in order to remove oxides and silicide islands hence improving a conductivity of bonding pad.

Allowable Subject Matter

6. Claims **25-26 & 33-34** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Prior art reference, taken along or in combination, do not teach or render obvious that a semiconductor device further comprising a terminal connected to said bonding pad, wherein a thickness of said silicide surface increases adhesion between said terminal and said bonding pad.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers

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for the organization where this application or proceeding is assigned are 703-308-7722

for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Donghee Kang
Examiner
Art Unit 2811

dhk
July 11, 2003